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Emerging Topics in EPRI Nuclear R&D

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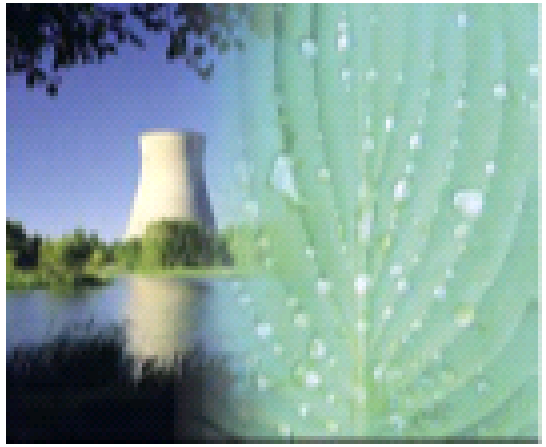
Thought Leadership

- **Long-Term Operations**
  - License renewal commitments
  - Technical basis for extended operations
- **Operational Issues**
  - Water availability and impacts
  - Cable aging, buried pipe, radiation management
  - Fukushima implications
- **Advanced Technology**
  - Accident-resistant fuel designs
  - Cobalt sequestration resins
- **New Plant Deployment**
  - Risk reduction via technology
  - Small modular reactors



Roadmap Diversity

Action Plan	Number	Example Technical Gap
Materials	18	Welding of Irradiated Materials for Reactor Internals
Fuel Reliability	6	PWR Grid-to-Rod Fretting
High Level Waste	4	Used Fuel Extended Storage
NDE	6	Concrete Characterization and NDE
Equipment Reliability	6	Cable Aging Management
Risk & Safety	5	Risk Assessment Methodologies for External Hazards
Advanced Nuclear	3	Configuration Management for New Plants
Chemistry/LLW/RM	9	Water Chemistry for Reducing Radiation Fields
Long-Term Operations	1	Equipment Life-Cycle Management
TOTAL	58	29

Roadmaps are living documents

Emerging Topics of Interest

- Support Effective Utility Response to the Fukushima Daiichi Lessons Learned
- Long-term Spent Nuclear Fuel Storage – Again!
- Small Modular LWR Reactors
- Health Effects of Low Dose Ionizing Radiation

Fukushima Response – EPRI's Role

- Improved Prevention, Coping and Mitigation Capabilities
- Technical Analysis to Achieve Greater Understanding
- Technical Transfer and Information Exchange

Assessing and Addressing External Hazard Risk

- Fukushima – and other recent events – brought home need to consider extreme hazards
- Current efforts focusing on
  - External flooding
  - Seismic events

- In the short term

➡ Develop approaches to assure plant safety

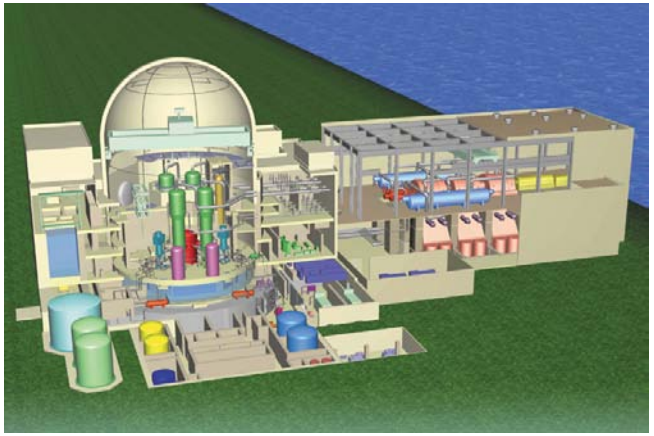
- In the longer term

➡ Develop improved methods for assessing and managing risks

Assessing and Addressing Spent Fuel Pool Risk

Focus of current efforts

- Relevant characteristics for existing spent-fuel pools
  - Potential for losses of inventory or cooling
  - Systems and facilities shared with core-cooling functions
- Enhance modeling of thermal-hydraulic response
- Generic risk models (BWR, PWR)
- Performance of pilot risk studies
  - Exelon/Peach Bottom
  - Interest by Spain and others



Severe Accident Management Guidance

Genesis of SAMGs: initiative part of long-term response to accident at TMI-2

Current efforts

- Update *Technical Basis Report*: underpinning of SAMGs
  - Address insights from Fukushima
  - Incorporate new information from severe-accident research and analysis since 1992

TBR update on target for completion in June 2012

- Ongoing support of industry updates of SAM Guidelines

Technical Evaluation of Fukushima Accident

Expertise: decades of severe-accident research

State-of-the-art modeling tools (MAAP5)

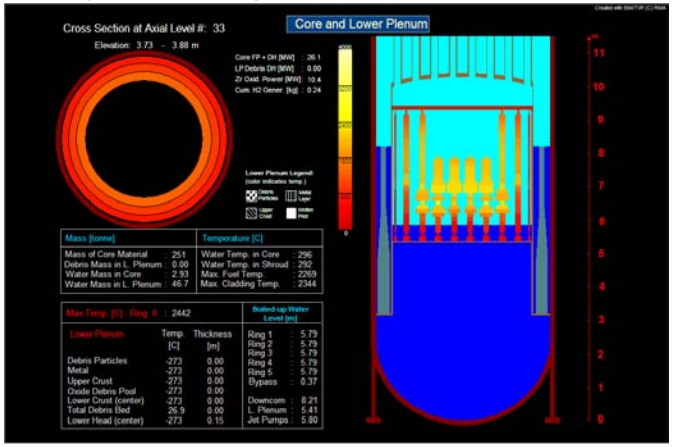
Development of in-depth understanding of accident

EPRI's Technical objectivity and credibility

Technical Evaluation of Fukushima Accident

Objectives

- Achieve in-depth understanding of the accident
- Provide sound basis for longer term industry decisions via
  - Enhanced analytical models for subsequent analyses
  - Comparisons and gap analyses by the global nuclear community



Tasks underway

- Confirm and document event progression
- Compile radiological transport and contamination data
- Broaden and leverage international participation

Technical Transfer - Exchange of Information

OBJECTIVE

Focus on lessons learned and actions taken.

Ensure broad dissemination of actions and analyses performed (or to be performed) worldwide.

- Identify & assess technology gaps emerging from *stress tests,* plant walkdowns, and evaluations
  - Collaborate with INPO, WANO, ENISS*, Owners Groups, and EPRI members and non-members
  - Interface with DOE, national labs, NRC and others
- Support member application of relevant EPRI technology
- TEPCO support – decontamination and decommissioning

* ENISS is the European Nuclear Installations Safety Standards Initiative

Long-term Spent Nuclear Fuel Storage Considerations

- Limited options exist world-wide
- Increased use of dry storage
- Extended Storage Collaboration Program
  - Storage system and fuel integrity
  - Transportation
  - High burn up fuel demo project

Small Modular Reactors

- EPRI's role
  - Ensure prospective nuclear plant owners have an objective basis for evaluating SMR technology
  - Develop a Utility Requirements Document (URD)
- Possible collaborative areas ~ ALWR Program
  - System and component assessments
  - Safety and risk analysis
  - Technical bases to address licensing issues

Health Effects of Low Dose Ionizing Radiation

- Understand the science of low dose ionizing radiation effects
- Better define the health risks from low doses
- Enhance policy maker and public (societal) understanding
- Evaluate implications for Emergency Planning
- Evaluate implications for industry practices, e.g., ALARA, if any

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